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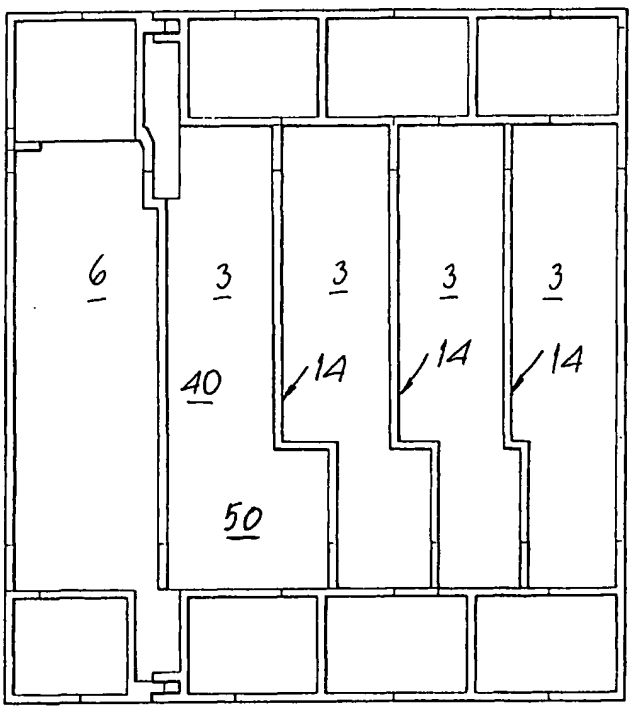
(54) Title: MODULAR FOUR-POLE RESIDUAL CURRENT CIRCUIT BREAKER



(57) Abstract: A modular four-pole residual current circuit breaker, comprising: --an enclosure, on which there are terminals for input and output connection to corresponding conductors of an electric circuit, with a front wall from which an actuation lever protrudes, a rear wall, two side walls that are substantially parallel to each other and whose distance is four times a base module M, a lower wall and an upper wall, the enclosure containing: --first, second, third and fourth magnetothermal interruption units, which are arranged mutually side by side and are separated by dividing walls, an input terminal and an output terminal being associated with the units; --a residual current protection unit, arranged at one of the lateral ends of the enclosure and laterally adjacent to the first magnetothermal interruption unit; its particularity consists of the fact that in a front view, the dividing wall between the first and second magnetothermal units is substantially step-shaped and forms a compartment for accommodating the first magnetothermal unit that has an upper part and a lower part that have mutually different widths, the lower part of the compartment being wider than the upper part and accommodating a transmission lever that is suitable to functionally couple the kinematic mechanism of the residual current unit with the kinematic mechanism of the magnetothermal units that are laterally adjacent to it.

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MODULAR FOUR-POLE RESIDUAL CURRENT CIRCUIT BREAKER

DESCRIPTION

The present invention relates to a modular four-pole residual current circuit breaker; more particularly, the present invention relates to a modular residual current circuit breaker that comprises, on one side, four magnetothermal interruption compartments and, laterally thereto, so as to form a single block, a residual current protection compartment.

It is known that the enclosure of a device that is termed modular has two mutually parallel side walls that are mutually spaced by a preset base multiple that is common to all modular devices of the same kind, as set by appropriate standards.

These modular devices are engaged on supporting guides by virtue of an appropriate shaped region provided on the wall for fixing said enclosure and are arranged mutually side by side so as to optimize space occupation.

In a modular multipole residual current circuit breaker, the magnetothermal interruption compartments are usually arranged parallel to each other and all have the same width, which is equal to one base module.

According to a first solution that is known in the art, the residual current protection chamber is usually arranged parallel to the magnetothermal interruption compartments and is laterally adjacent, on one side or the other, with respect to the magnetothermal interruption assembly that has formed, and its width is generally equal to three times the base module.

The main drawback of this solution is the fact that the total width of the resulting four-pole residual current circuit breaker is usually equal to seven times the base module; accordingly, the space required during application is considerable.

A second solution that is known in the art provides an embodiment in which the total width of a four-pole residual current circuit breaker is brought to four

times the base module, with the consequent benefit, by virtue of its smaller dimensions, of a more efficient utilization of the space available for assembly.

This solution is achieved because the width of each one of the magnetothermal interruption compartments is equal to the base module and the residual current protection chamber is arranged longitudinally above or below the magnetothermal interruption compartments, as if the volume available inside the enclosure were divided in two along a plane that is perpendicular to the side walls of the enclosure and to its fixing wall, so that part of this volume is divided transversely between the various magnetothermal interruption compartments while the other part is occupied longitudinally by the residual current protection element.

Even this embodiment, however, has drawbacks; in particular, the axis of the magnetic protection device of each one of the magnetothermal interruption compartments lies in practice transversely to the fixing wall of the enclosure, to the detriment of the volume available for the arc quenching chamber that is normally associated with the interruption contacts, consequently reducing the breaking capacity.

Furthermore, is this solution the residual current protection compartment lies longitudinally along the entire width of the enclosure and transversely to the magnetothermal interruption compartments, so as to make the electrical connections among the many internal components of these compartments particularly complicated and disadvantageous to provide.

According to a third solution that is known in the art, the residual current protection compartment is assembled with the magnetothermal interruption compartments by arranging it in a central position; in practice, two magnetothermal circuit breakers are assembled sequentially, followed by the residual current unit and then by the second pair of magnetothermal circuit breakers.

This particular embodiment does not allow to assemble all the magnetothermal circuit breakers in the absence of the residual current protection compartment, thus preventing the possibility to perform tests on the entire magnetothermal part without the residual current protection compartment.

Accordingly, in case of poor operation of the magnetothermal parts, the assembled residual current part is also unusable, consequently wasting material and increasing production times and costs.

Furthermore, the need to preassemble the circuit breaker completely forces the production and stocking of circuit breakers of various sizes and with various performances, regardless of the actual demands and needs of the market and with the consequent risk of holding in stock devices that might not be required.

The aim of the present invention is to obviate the drawbacks cited above, and in particular to provide a modular four-pole residual current circuit breaker that is highly compact and has an optimized performance.

Within the scope of this aim, an object of the present invention is to provide a modular four-pole residual current circuit breaker that is simple to manufacture and most of all facilitates the steps for the assembly of the various internal components.

Another object of the present invention is to provide a modular four-pole residual current circuit breaker that facilitates testing and at the same time allows to organize and optimize inventory reserve management.

Another object of the present invention is to provide a modular four-pole residual current circuit breaker that is highly reliable, relatively easy to provide, and at competitive costs.

This is achieved by means of a modular four-pole residual current circuit breaker, comprising:

-- an enclosure, on which there are terminals for input and output connection to corresponding conductors of an electric circuit, said enclosure having a front

wall from which an actuation lever protrudes, a rear wall, two side walls that are substantially parallel to each other and whose distance is four times a base module M, a lower wall and an upper wall, said enclosure containing:

-- first, second, third and fourth magnetothermal interruption units, which are arranged mutually side by side and are separated by dividing walls, an input terminal and an output terminal being associated with said units;

-- a residual current protection unit, arranged at one of the lateral ends of said enclosure and laterally adjacent to said first magnetothermal interruption unit;

characterized in that, with respect to a front view, the dividing wall between said first and second magnetothermal units is substantially step-shaped and forms a compartment for accommodating the first magnetothermal unit that has an upper part and a lower part that have mutually different widths, the lower part of said compartment being wider than the upper part and accommodating a transmission lever that is suitable to functionally couple the kinematic mechanism of the residual current unit with the kinematic mechanism of the magnetothermal units that are laterally adjacent to it.

In this manner, the space available inside the enclosure is conveniently distributed between the magnetothermal interruption units and the residual current interruption unit, obtaining, by means of an appropriate configuration of the dividing walls, the space required to receive the lever for coupling between the magnetothermal part and the differential part; accordingly, the assembly is highly compact, allowing to obtain a four-pole residual current circuit breaker with a total width equal to four times the base module.

Another considerable advantage of the circuit breaker according to the invention is the fact that by virtue of the arrangement of the residual current protection compartment at one of the ends of the enclosure, it is possible to divide the operation for assembling the circuit breaker into two separate steps, the first one being related to the assembly of the magnetothermal

compartments, the second one being related to the assembly of the residual current protection compartment, to be performed after a test on the magnetothermal section, which is already ready, and only depending on the specific requirements and/or needs of application.

This allows to avoid assembling the entire circuit breaker if the magnetothermal section does not pass the test; moreover, this approach allows to optimize inventory reserves, since it is possible to preassemble and stock only the magnetothermal section, assembling the remaining residual current part when required and according to the required protection power. This reduces the costs of inventory reserves and production costs if the various tests are not passed.

Moreover, the arrangement according to the invention allows advantageously to assemble some components in the manner that is already known in the art, with a consequent economic benefit.

Further characteristics and advantages of the invention will become apparent from the description of preferred but not exclusive embodiments of the circuit breaker according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a perspective view of a four-pole residual current circuit breaker according to the invention;

Figure 2 is a schematic view of the internal arrangement of the compartments of the circuit breaker of Figure 1;

Figure 3 is a perspective view of the set of the internal components of said four-pole residual current circuit breaker;

Figure 4 is a front view of the set of assembled magnetothermal compartments;

Figure 5 is a schematic side view of a magnetothermal interruption unit used in the four-pole residual current circuit breaker according to the invention;

Figure 6 is a schematic side view of the residual current protection unit used in the circuit breaker according to the invention;

Figure 7 is a detail perspective view of a transmission lever during coupling with the kinematic mechanism of the residual current unit and with the kinematic mechanism of the magnetothermal unit that is laterally adjacent thereto.

With reference to the above cited figures, the four-pole residual current circuit breaker 1 according to the invention comprises four magnetothermal interruption units 3, which are mutually assembled in a same enclosure 2 that has a width L equal to four times a base module M, said units being all mutually laterally adjacent, an input terminal 4 and an output terminal 5 being associated with each one of said units, and a residual current protection unit 6.

In particular, said base module, taking into account normal manufacturing tolerances, is generally equal to 17.5 ($_0^{+0.5}$) mm, as set by the DIN 43880 standard.

As shown in Figure 1, the enclosure 2 comprises: two parallel side walls 7, whose distance determines a width equal to L; a rear fixing wall 8, which is shaped appropriately so as to facilitate engagement on a suitable supporting guide, not shown in the figures, in manners that are widely known in the art; an upper wall 10 and a lower wall 11, which are perpendicular to the fixing wall 8 and to the side walls 7 and on which the input and output terminals protrude respectively for the connection of conductors of a circuit with the magnetothermal interruption units 3. Finally, the enclosure 2 has a front wall 13 that lies substantially parallel to the fixing wall 8 and from which a rotating actuation lever 19 protrudes outside said enclosure 2 and is available to users; furthermore, in the illustrated embodiment, said wall 13 allows access to the clamps for tightening or loosening the corresponding input terminal 4 and output terminal 5; as an alternative, both the terminals and the corresponding clamps might be arranged differently according to the requirements.

As shown in Figures 2 and 4, the magnetothermal interruption units 3 are

arranged in the enclosure 2 so that they are mutually side by side and separated by partitions or walls 14, which help to form respective containment compartments; furthermore, the residual current protection unit 6 is in turn arranged at one of the lateral ends of said enclosure and is laterally adjacent to one of the magnetothermal interruption compartments 3.

Advantageously, in the embodiment of the circuit breaker according to the invention, in a front view, at least the dividing wall 14 that is interposed between the magnetothermal unit that is laterally adjacent to the residual current unit 6 and the magnetothermal unit that directly follows it is substantially step-shaped and forms a containment compartment that has an upper part 40 and a lower part 50 that have mutually different widths, the lower part 50 being wider than the upper part 40 and accommodating a transmission lever; said lever, designated by the reference numeral 28 in Figure 7, is suitable to functionally couple the kinematic mechanism of the residual current unit 6, generally designated by the reference numeral 60, with the kinematic mechanism of the magnetothermal unit 3 that is laterally adjacent thereto, designated by the reference numeral 30.

In particular, as shown in Figure 7, the transmission lever 28 has a contoured body with means for functional coupling, at one end, to a first lever 61 of the kinematic mechanism 60, for example a relay reset lever, and at the other end to a second trip lever 31 that belongs to the kinematic mechanism 30 of the unit 3 that is laterally adjacent to the residual current unit 6; furthermore, said levers 28, 61 and 31 are mutually coupled so as to be mutually aligned along an axis B1 that lies along the line that connects the two side walls 7.

Preferably, and as shown in Figure 2 and 4, all the dividing walls 14 that mutually separate in pairs the magnetothermal interruption units 3, have a substantially step-like shape in a front view and form containment compartments for the units 3 which have an upper part 40 and a lower part 50

that have preferably mutually different widths; furthermore, the lower part 50 of the first compartment 3, i.e., the compartment that is adjacent to the residual current protection unit 6, is wider than the lower part of the remaining magnetothermal interruption compartments 3.

According to the illustrated embodiment, the input terminals 4, which are all mutually aligned on one side and, at said input terminals, the output terminals 5, which are likewise all mutually aligned, on the other side, are distributed with a regular spacing that is equal to the base module M from one of the side walls 7 to the other, so that at right angles to said side walls 7 they are all staggered with respect to the magnetothermal interruption compartments 3 with which they are respectively associated.

In practice, the input or output terminals 4 or 5 that are at the end of the corresponding alignments are at a distance from the side walls 7 of the enclosure 2 that is equal to half the base module M.

All the magnetothermal interruption units 3 have substantially the same structure.

As shown in Figures 3 to 5, said units comprise, inserted between the respective input and output terminals 4 and 5, an electromagnetic device 15 for protection against overcurrents/short circuits, at least one fixed contact 16 and a moving contact 17, with which at least one arc quenching chamber 23 is associated, and a thermal protection device 18, for example a bimetal, for protection against overloads; furthermore, each magnetothermal protection unit 3 comprises an opening/closure kinematic mechanism 30, the kinematic mechanisms 30 of the various units 3 being mutually functionally connected according to embodiments that are known in the art and are accordingly not described in detail.

Said kinematic mechanisms 30, which comprise in particular the already mentioned release lever 31, and a contact-carrying lever 32 on which the

respective moving contact 17 is arranged, according to embodiments that are widely known in the art and are therefore not described in detail, are suitable, under the action of the protection devices 15 or 18, to make the moving contacts 17 pass from a closed position, in which they are coupled to the corresponding fixed contacts 16, to an open position, in which they are instead separated from said fixed contacts, as shown in Figure 5. For the opposite transition, from an open position to the closed position, the kinematic mechanisms 30 are functionally controlled by the actuation lever 19.

In particular, each electromagnetic protection device 15 has a winding coil 20, which is arranged around a supporting structure 21, and a release pin 22, which is functionally controlled by the coil 20 and is suitable to act on the corresponding kinematic mechanism 30, generally on the corresponding release lever 31. In the embodiment of the circuit breaker according to the invention, and as shown in Figures 4 and 5, the axis A_1 of each electromagnetic protection device 15, i.e., the axis along which the corresponding release pins 22 act, runs parallel to the side walls 7 of the enclosure 2, along the line that connects the upper and lower walls 10 and 11. Figures 4 and 5 show the axis A_1 of a single pin 22 for the sake of simplicity in illustration. Furthermore, the arc quenching chamber 23 is arranged between the respective electromagnetic protection device 15 and the fixing wall 8 of the enclosure 2. By virtue of this arrangement, each electromagnetic protection device 15 can advantageously lie parallel to the fixing wall 8 of the enclosure 2, to the benefit of the space available for the arc quenching chambers 23 and therefore of the breaking capacity, which is not reduced in any way.

Another advantageous aspect is constituted by the fact that the winding coil 20 of the protection devices 15 can be provided by adopting standardized conductors having a rectangular cross-section or flat wires, wherein the larger dimension lies parallel to the axis A_1, Figure 5; it is thus possible to minimize

the transverse space occupation of each electromagnetic protection device 15. As an alternative, it is possible to use conductors having a circular cross-section.

In turn, the residual current protection unit 6, accommodated in the corresponding compartment formed by one of the side walls 7 and by an additional partition 14, comprises a fault detector 24, which is suitable to detect the presence of a residual current, and a per se known relay 25, which is controlled by the fault detector 24 and is provided with a movable release piston 29, as shown in Figure 6. The fault detector 24 comprises a toroidal core 26 on which primary conductors 27 and a secondary winding are wound; each one of said primary conductors is electrically connected to a corresponding electromagnetic protection device 15, and the secondary winding, not shown in the figures, is functionally connected to the relay 25. In particular, as shown in Figure 3, in a front view the toroidal core 26 is advantageously arranged at the dihedral angle formed by the upper wall 10 and by one of the side walls 7 of the enclosure 2, with an axis A_2 that is orientated substantially along the line that connects the front and rear walls 13 and 8; furthermore, the relay 25 is arranged under the toroidal core 26 and to the rear of the kinematic mechanism 60 of the residual current protection unit, so that the release piston 29 can move along an axis A_3 that lies on a plane that is parallel to the side walls 7 of the enclosure 2, along a line that connects the front wall 13 and the rear wall 8.

In operating conditions, when the residual current is higher than a preset limit, a voltage is generated across the secondary winding, and its representative signal is supplied to the relay 25 and causes the actuation of the piston 29; in turn, the piston 29 actuates the kinematic mechanism 60 and by virtue of the coupling of the levers 61-28-31 the movement is transmitted to the mechanisms 30 so as to separate the contacts. Subsequent action on the actuation lever 19 causes, in this case also, the reclosing of the circuit breaker so that the lever 61 resets the

relay, repositioning the pivot 29.

In practice it has been found that the four-pole residual current circuit breaker according to the invention fully achieves the intended aim and objects, with significant advantages with respect to what is known in the background art.

As mentioned, the entire system is in fact assembled in an enclosure that has optimized dimensions and particularly has a width that is four times a base module M, with a consequent benefit in practical installation and with a functional performance that is not altered in any way by virtue of the particular arrangement of the various components.

Furthermore, by virtue of the arrangement of the residual current part at one end of the enclosure, the assembly of the circuit breaker can be divided advantageously into two separate steps, a first one which relates to the assembly of the magnetothermal section and a second one that relates to the assembly of the residual current section; in this manner, once the first step has ended, it is possible to perform the necessary functional tests only on the magnetothermal part that is already ready. This allows to avoid unnecessary waste of residual current protection components in case of a malfunction that is due only to the magnetothermal section. It is also possible to stock the already-assembled magnetothermal section and complete the four-pole residual current circuit breaker with the remaining residual current section when necessary and according to the required protection performance; this avoids inventory reserves of the already-assembled residual current circuit breaker, with a considerable reduction of operating costs.

There is also the important possibility to assemble some components in the manner that is already known in the art, with a consequent economic benefit.

The circuit breaker thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials and the dimensions may be any according to the requirements and the state of the art.

CLAIMS

1. A modular four-pole residual current circuit breaker, comprising:

-- an enclosure, on which there are terminals for input and output connection to corresponding conductors of an electric circuit, said enclosure having a front wall from which an actuation lever protrudes, a rear wall, two side walls that are substantially parallel to each other and whose distance is four times a base module M, a lower wall and an upper wall, said enclosure containing:

-- first, second, third and fourth magnetothermal interruption units, which are arranged mutually side by side and are separated by dividing walls, an input terminal and an output terminal being associated with said units;

-- a residual current protection unit, arranged at one of the lateral ends of said enclosure and laterally adjacent to said first magnetothermal interruption unit; characterized in that, with respect to a front view, the dividing wall between said first and second magnetothermal units is substantially step-shaped and forms a compartment for accommodating the first magnetothermal unit that has an upper part and a lower part that have mutually different widths, the lower part of said compartment being wider than the upper part and accommodating a transmission lever that is suitable to functionally couple the kinematic mechanism of the residual current unit with the kinematic mechanism of the magnetothermal units that are laterally adjacent to it.

2. The residual current circuit breaker according to claim 1, characterized in that in a front view said dividing walls that mutually separate the magnetothermal interruption units are substantially step-shaped and form containment compartments for said magnetothermal interruption units which have an upper part and a lower part with mutually different widths, the lower part of the compartment that accommodates said first magnetothermal

interruption unit being wider than the lower part of the remaining compartments for accommodating the magnetothermal interruption units.

3. The residual current circuit breaker according to claim 1 or 2, characterized in that said transmission lever comprises a contoured body provided with means for functional coupling, at one end, to a first lever that belongs to the kinematic mechanism of the residual current protection unit and, at the other end, to a second lever that belongs to the kinematic mechanism of said first magnetothermal protection unit, said first lever, said transmission lever and said second lever being mutually coupled so as to be aligned along a first axis that is orientated along a line that connects the two side walls of the enclosure.

4. The residual current circuit breaker according to one or more of the preceding claims, characterized in that said input terminals, at one end, and said output terminals, at the other end, are distributed with a uniform spacing that is equal to a base module M and are staggered with respect to the containment compartments of the magnetothermal interruption units with which they are functionally associated.

5. The residual current circuit breaker according to one or more of the preceding claims, characterized in that said magnetothermal interruption units comprise an electromagnetic protection device that comprises a winding coil and a moving release pin associated therewith, said release pin being arranged along a second axis that is substantially parallel to the side walls of the enclosure, along a line that connects the upper wall and the lower wall.

6. The residual current circuit breaker according to claim 5, characterized in that said winding coil comprises conductors that have a substantially rectangular transverse cross-section.

7. The residual current circuit breaker according to one or more of the

preceding claims, characterized in that the residual current protection unit comprises a fault detector, which is suitable to detect a residual current, and a relay, which is controlled by the fault detector and is provided with a moving release piston, said fault detector comprising a toroidal core on which primary conductors and a secondary winding are wound, each one of said primary conductors being connected to a corresponding electromagnetic protection device, said secondary winding being functionally connected to the relay.

8. The residual current circuit breaker according to claim 7, characterized in that said toroidal core is arranged at the dihedral angle formed by the upper wall and by one of the side walls of the enclosure, with its axis directed substantially along the line that connects the front wall and the rear wall.

9. The residual current circuit breaker according to claim 7 or 8, characterized in that in a front view said relay is arranged under said toroidal core and to the rear of the kinematic mechanism of the residual current protection unit, so that the release piston can move along a third axis that is arranged on a plane that is parallel to the side walls of the enclosure, along a line that connects the front and rear walls.

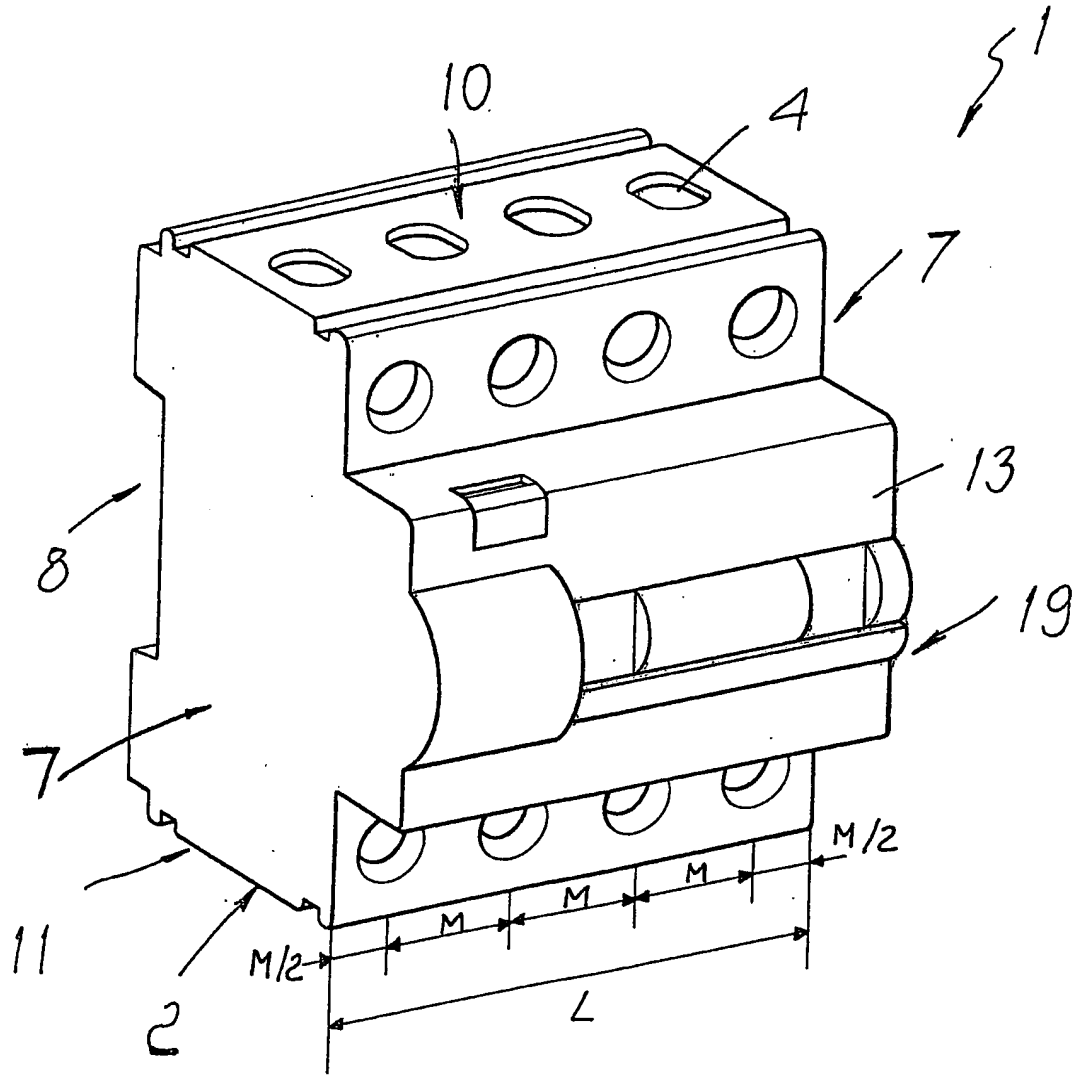

Fig. 1

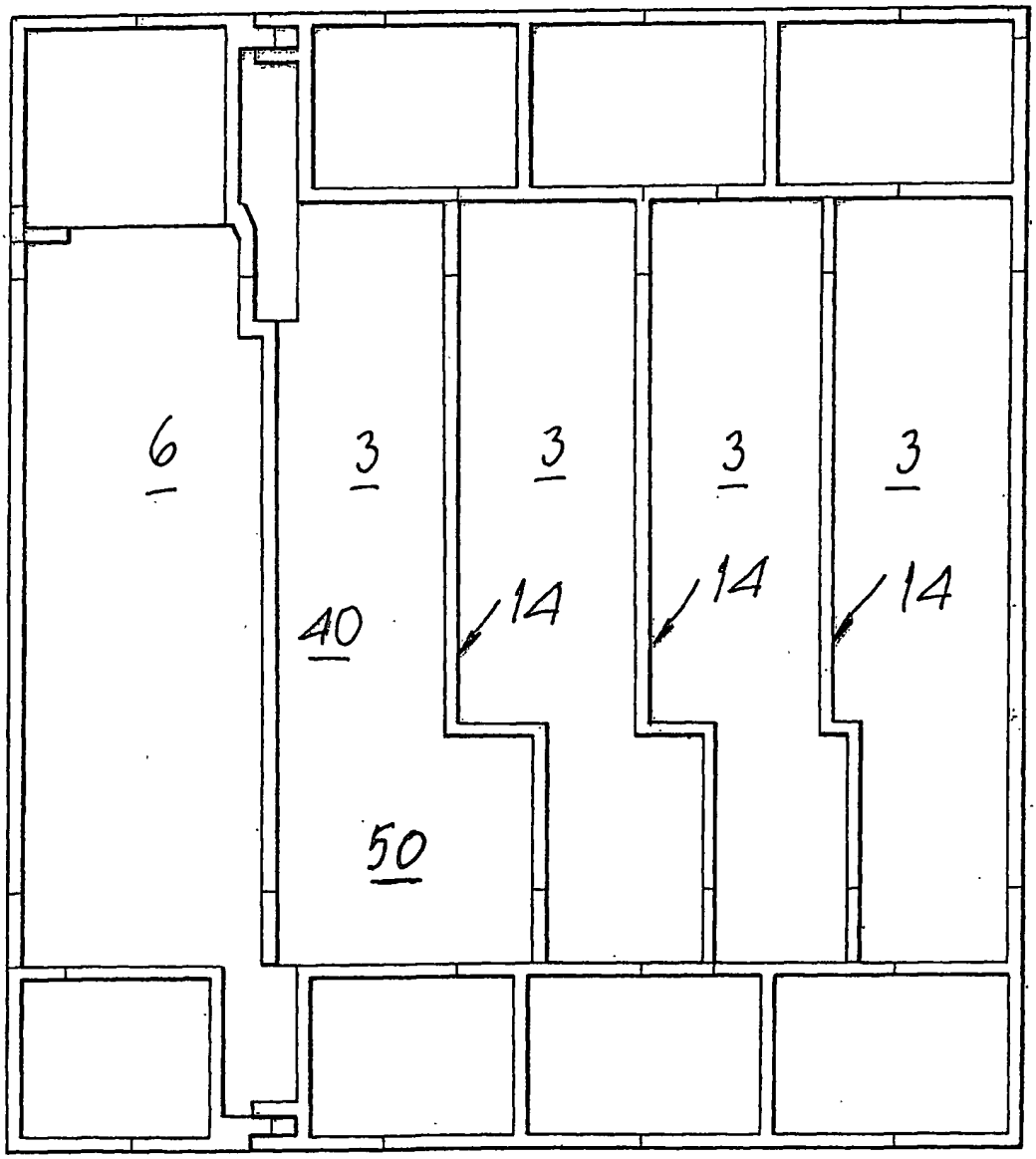

Fig. 2

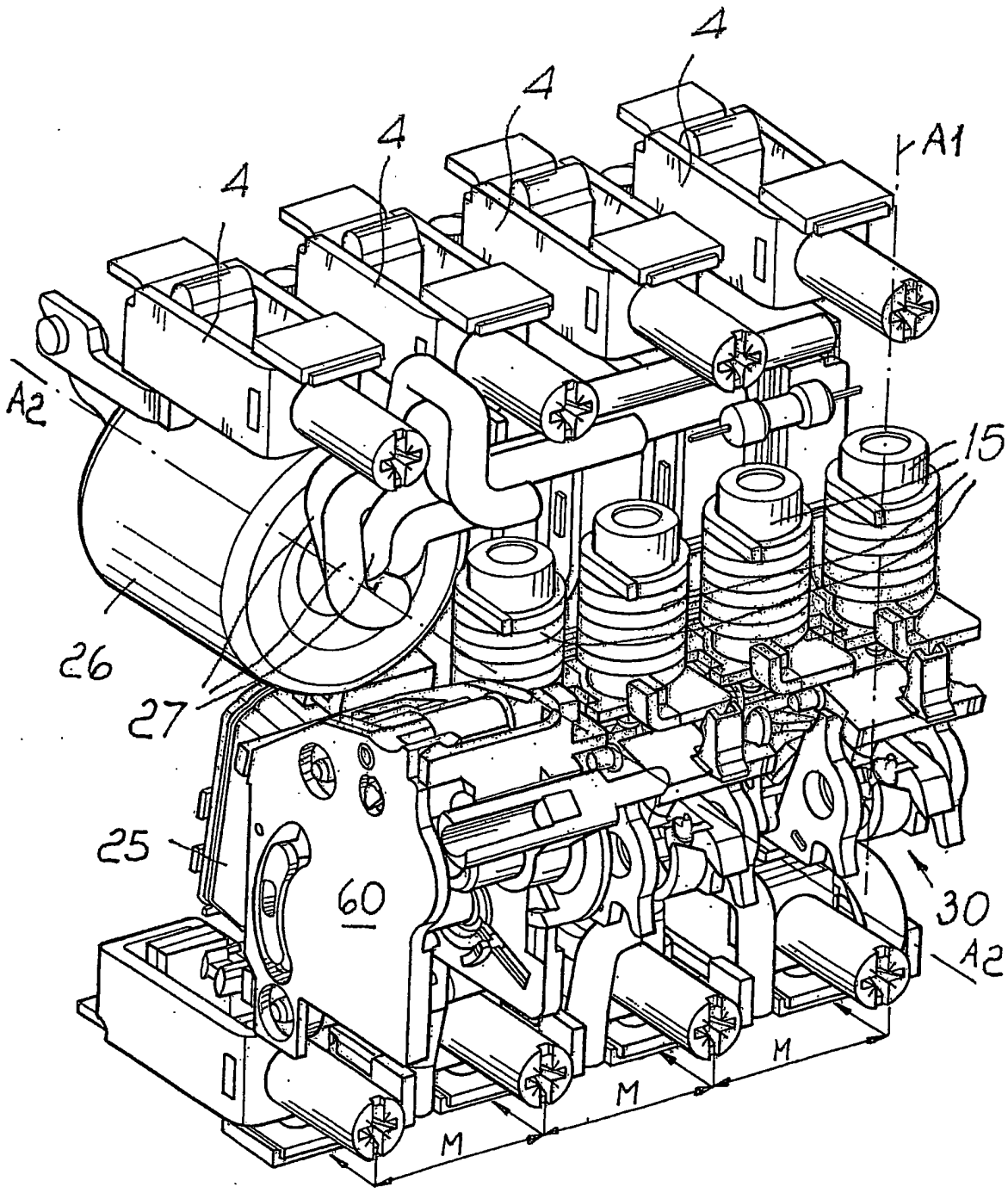

Fig. 3

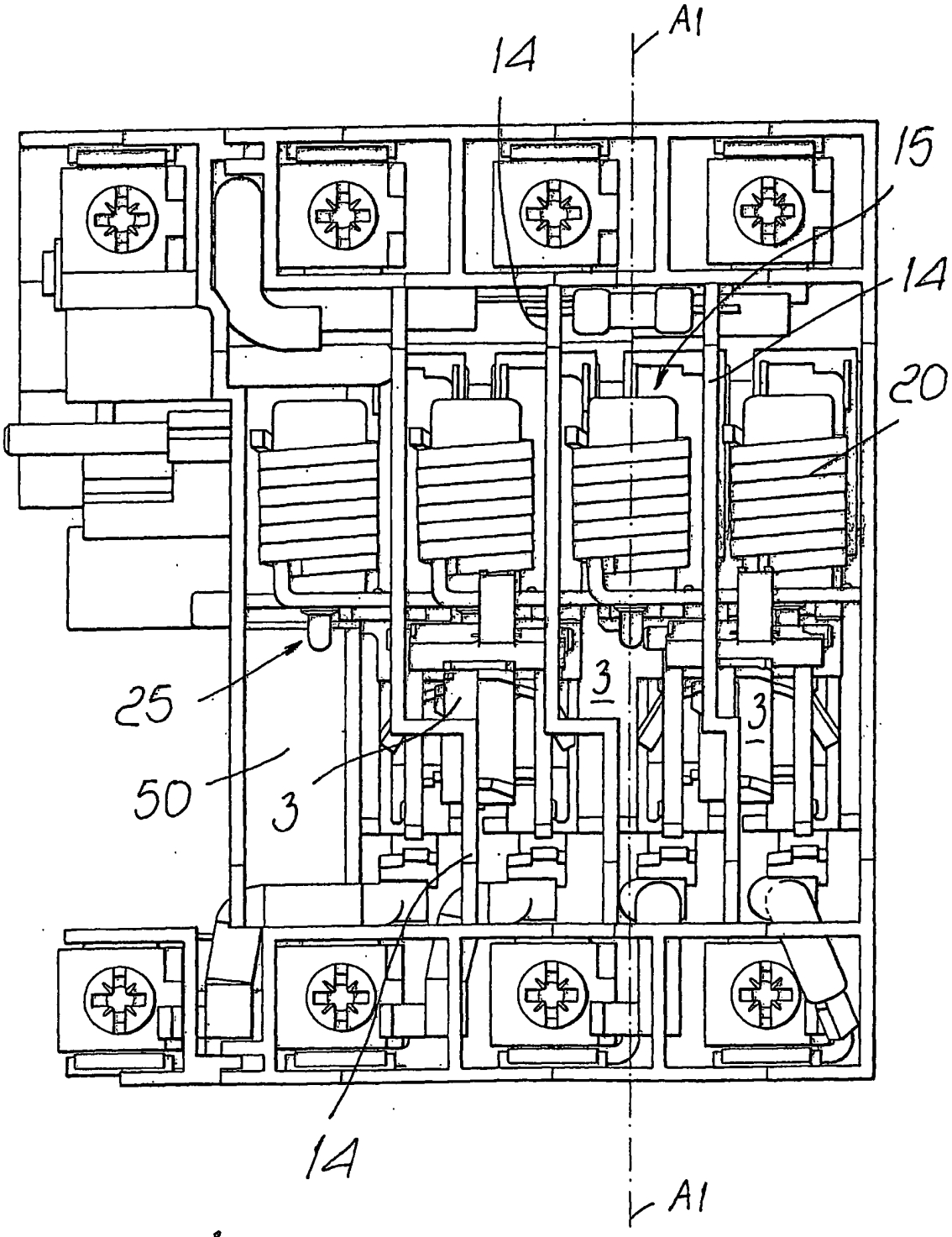

Fig. 4

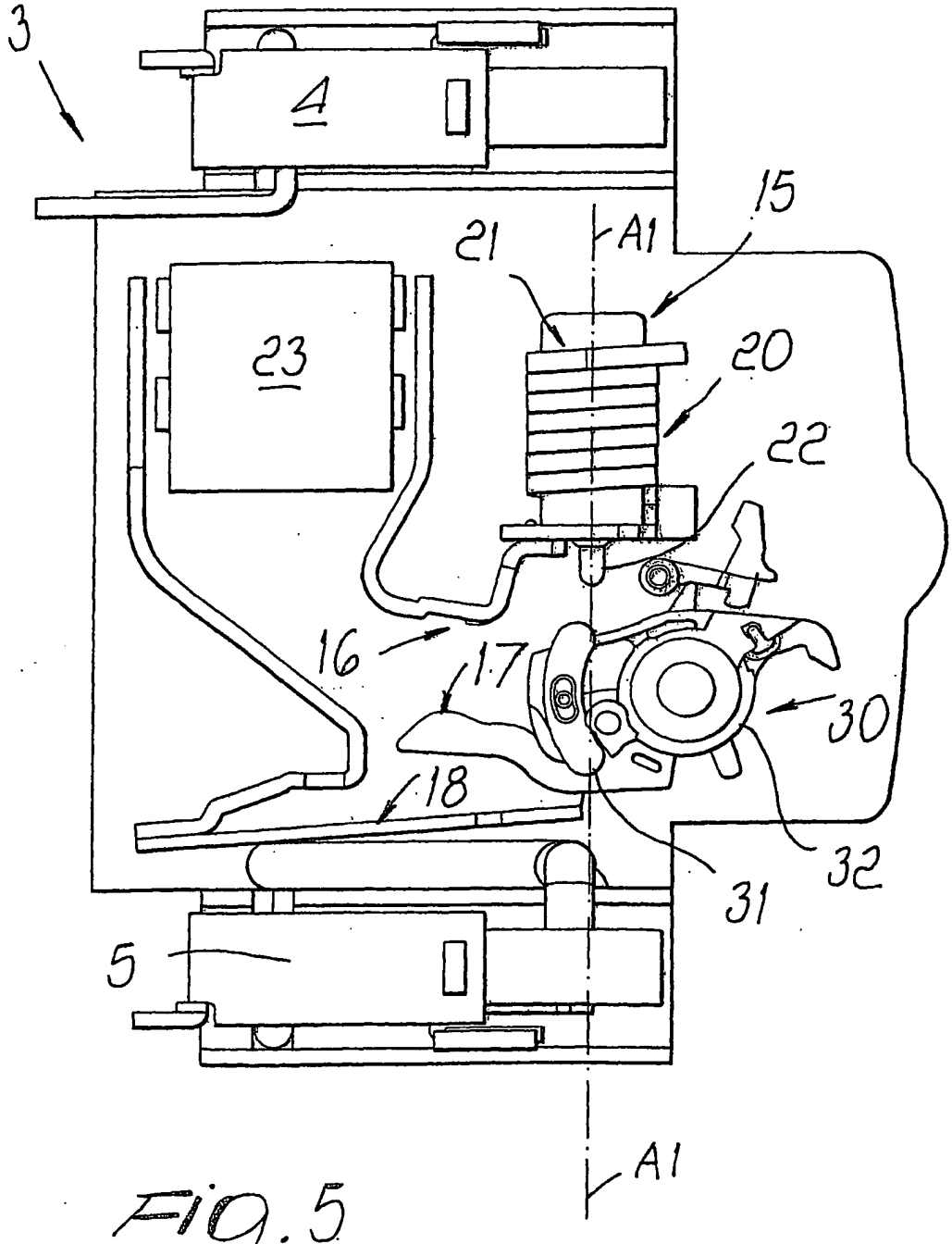

Fig. 5

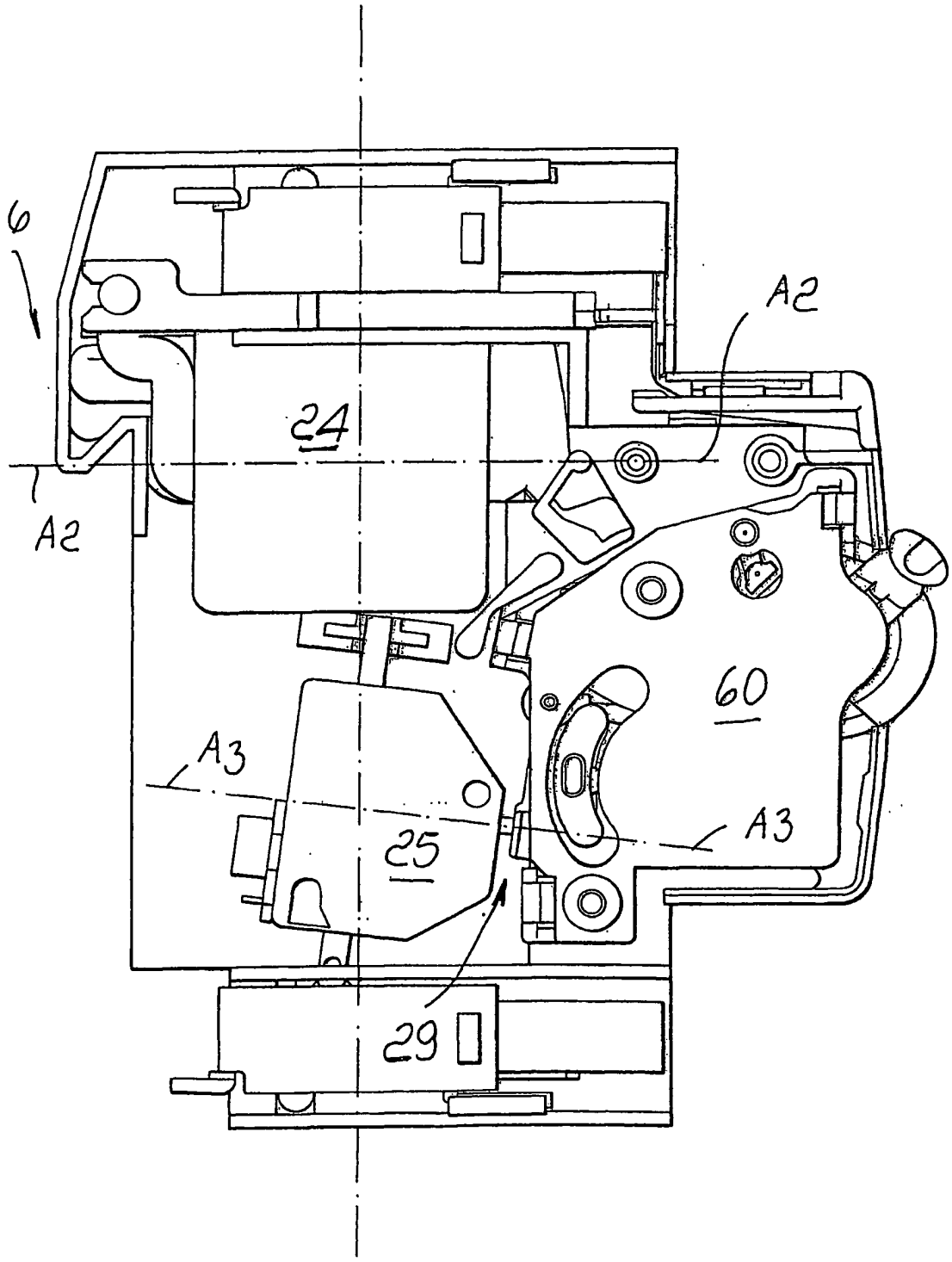

Fig. 6

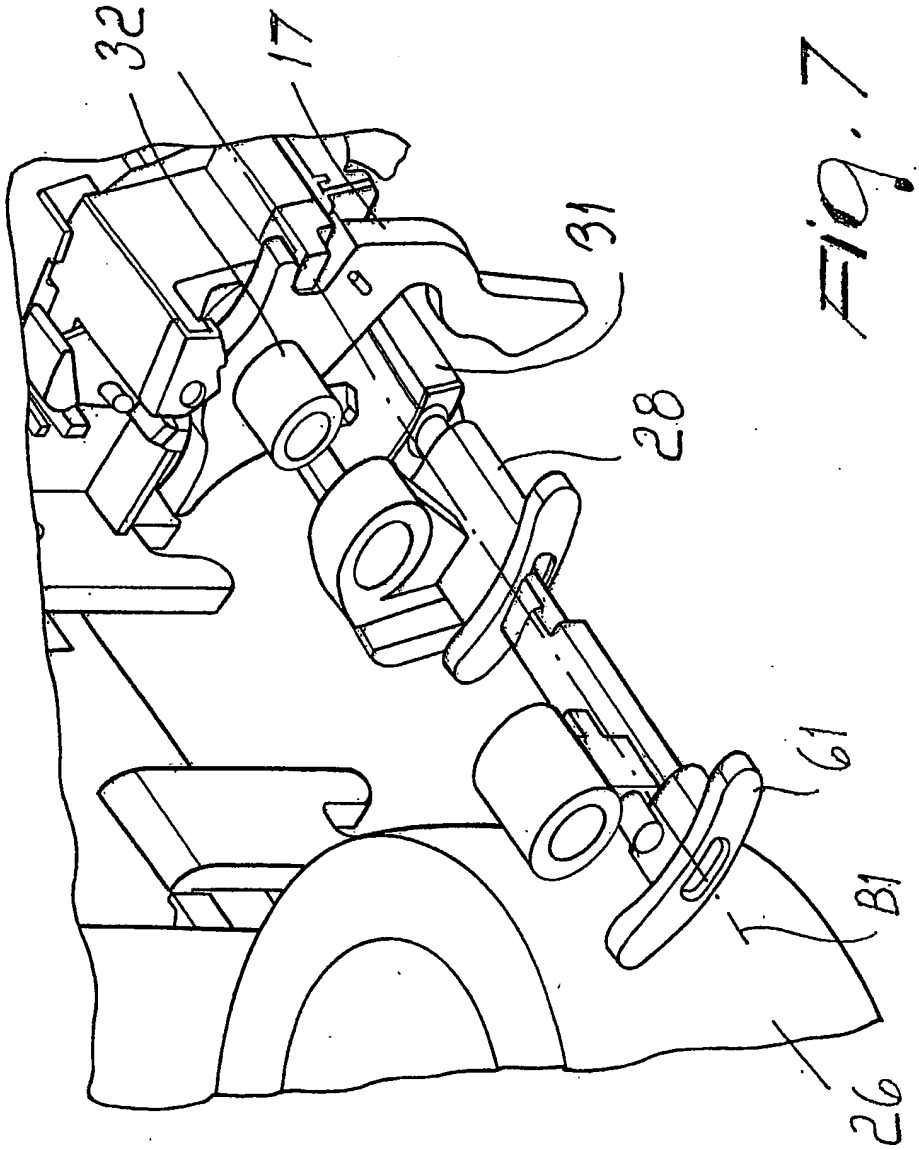

Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/08212

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01H83/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 1 371 007 A (SIEMENS AG) 28 August 1964 (1964-08-28) page 1, left-hand column, paragraph 2 -right-hand column, paragraph 1-	1
A	EP 0 948 021 A (LEGRAND SNC ;LEGRAND SA (FR)) 6 October 1999 (1999-10-06) abstract	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
7 November 2002	14/11/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Libberecht, L

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 02/08212

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
FR 1371007	A	28-08-1964	DE	1169015 B	30-04-1964
EP 0948021	A	06-10-1999	FR	2777110 A1	08-10-1999
			EP	0948021 A1	06-10-1999
			HU	9900869 A2	28-12-1999
			PL	332348 A1	11-10-1999